



US006580779B2

(12) **United States Patent**
Avinash et al.

(10) **Patent No.:** US 6,580,779 B2
(45) **Date of Patent:** Jun. 17, 2003

(54) **CONTRAST ADJUSTMENT OF A
DECOMPOSED X-RAY IMAGE RELATIVE
TO THE CONTRAST OF ANOTHER X-RAY
IMAGE**

(75) **Inventors:** Gopal B. Avinash, New Berlin, WI
(US); John M. Sabol, Sussex, WI (US)

(73) **Assignee:** GE Medical Systems Global
Technology Company, LLC,
Waukesha, WI (US)

(*) **Notice:** Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 10 days.

(21) **Appl. No.:** 09/989,044

(22) **Filed:** Nov. 20, 2001

(65) **Prior Publication Data**

US 2003/0095630 A1 May 22, 2003

(51) **Int. Cl.⁷** H05G 1/64

(52) **U.S. Cl.** 378/98.9; 378/53; 378/98.11;
382/132

(58) **Field of Search** 378/5, 51, 53,
378/62, 98.8, 98.9, 98.11, 707; 382/132

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,052,433 A * 4/2000 Chao 378/98.9

6,343,111 B1 * 1/2002 Avinash et al. 378/98.11
6,501,819 B2 * 12/2002 Unger et al. 378/98.9
2002/0186872 A1 * 12/2002 Avinash et al. 382/132

* cited by examiner

Primary Examiner—Drew A. Dunn

(74) *Attorney, Agent, or Firm*—McAndrews, Held &
Malloy, Ltd.; Peter J. Vogel; Michael A. Dellapenna

(57) **ABSTRACT**

An X-ray system 100 uses a display (114) to display pictures (124) generated in response to an X-ray first range of energy levels and an X-ray second range of energy levels different from the first range of energy levels. Pictures resulting from a substantially single range of X-ray energy levels also are displayed. A source (102) of X-rays transmits X-rays at the first range of energy levels through an object (106) to create in an image sensor (108) a first image and transmits X-rays at the second range of energy levels through an object to create a second image in the image sensor. A processor (110) calculates a first decomposed image from the first and second images according to a first decomposition algorithm, calculates a second decomposed image from the first and second images according to a second decomposition algorithm and calculates a contrast adjusted image in response to the first and second decomposed images. The first picture is displayed in response to the contrast adjusted image and the second picture is displayed in response to the first image.

26 Claims, 6 Drawing Sheets

